XVII.—*On the probable Metamorphosis of* Pedicularia *and other forms; affording presumptive evidence that the Pelagic* Gasteropoda, *so called, are not adult forms, but, as it were, the Larvæ of well-known genera, and perhaps confined to species living in deep water.* *By* John Denis Macdonald, *Assistant-Surgeon of H.M.S. 'Herald,' employed on Surveying Service in the South-western Pacific, under the command of Captain* H. M. Denham, *R.N., F.R.S.* *Communicated by* G. Busk, *F.R.S., F.L.S.*

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It has been long known that certain genera of Gasteropoda, which are shell-less in the adult state, possess both shell and operculum not only while yet within the ovum, but for some little time after their liberation, and that ciliated vela precede the more perfect development of the foot. This is especially true of the *Nudibranchs*; and *Janthina*, which exhibits so near an approach to them in its organization, merely loses the little operculum of its embryonic condition, while the spiral shell is retained. But a more striking change than this occurs in the case of the genus *Pedicularia*, if my observations be correct; for I believe that I have identified the anatomy of a certain species whose shell presents a beautifully cancellated nucleus, with that of one of our little pelagic Gasteropods also having a cancellated shell, but presenting an aperture so closely resembling that of *Cheletropis* as to have misled me in naming figures of its labial and lingual dental organs, given in illustration of a former paper. I am, however, now in a position to prove that the oral teeth of *Cheletropis* are not lateral as in the little Gasteropod just referred to, and that its lingual ribbon is triserial and constructed on the type of that of *Murex*, *Purpura*, *Turbinella*, *Ricinula*, and such genera,—not septiserial as in *Pedicularia* and the little animal which I believe to be its fry. In the latter case moreover, it must be mentioned that the external series of uncini are often rudimentary, or not at all apparent,—a fact which is clearly in accordance with the common law of development of the lingual ribbon (as noticed in a previous paper, with an illustrative figure selected from the fry of *Cypræa umbilicata*). Without reference to the contained animals, the most acute conchologist could only regard *Cheletropis Huxleyi* and its little oceanic ally as distinct species of one genus, although we now know that it would be a violation of the simplest anatomical principles to place them even in the same family. Here, to a certain extent, similar conditions have arisen out of similar necessities in two otherwise very dissimilar beings. The final modelling, and thickening of the lip, moreover, afford no proof whatever that these shells have attained their adult state; for this change is usual in other cases, as in *Carinaria*, where its further progress is more easily traced, not only as an indication of the close of one stage of development, which had been going forward during the early part of the active life of the being, but as establishing a basis upon which the characteristic lines of growth of the future shell are laid.

Macgillivraia pelagica possesses the labial plates of *Natica* or *Triton*, and the lingual

teeth of *Ranella* or *Dolium*, with the spherical otolithes common to all; and it is highly probable that it will ultimately prove to be the young of some neighbouring genus. The little shell itself is perfectly identical with the summit of the spire of a species of *Malea* which is very common in the South Seas. I regret much that I have not yet had an opportunity of examining the animal of the latter for the purpose of more accurate comparison; but this much I can say—that the lingual teeth of *Dolium*, which cannot be far removed from *Malea*, very closely resemble those of *Macgillivraia*.

I formerly figured and described a pelagic Gasteropod with six ciliated arms, and which I believe may be safely referred to the *Tritonidæ*. I now offer the portrait of another species, obviously belonging to the same genus, though occupying a very differently shaped shell. In the paper alluded to I also noticed a minute *Natica*, with mentum, lateral labial plates, septiserial tongue-strap, and, in fact, only differing from other or at least full-grown members of the genus in the possession of a cervical circlet of ciliated arms, and a vesicular float; but I am now quite satisfied that I have identified this species with the nucleus of a handsomely spotted *Natica* occurring in deep water.

It is very remarkable that the characteristics just mentioned should be present in all the little pelagic Gasteropoda, while their internal anatomy unmistakeably refers them to very different families. But if, in connexion with these particulars, we take into consideration the large size of the fatty globules contained in the sacculi of the liver, indicative of almost incipient development, and the total absence of *ova* or *spermatozoa* (at least so far as the matter has yet been investigated), it can scarcely be doubted that these little creatures are not perfect, but transitional forms, the further development of whose head and proboscis, coincident with the shedding of the ciliated arms and a general adaptation to a new sphere of existence, may, with all propriety, be regarded as a veritable metamorphosis. It also appears to me that a bold indication of a developmental change such as this, is exhibited in the abrupt transition from the marking of the young shells into the very different and characteristic sculpturing of the adult state of the corresponding species,—an occurrence which takes place long subsequent to the period at which, in some instances, a sinistral nucleus merges into a dextral shell.

Since the above remarks were written, as if to afford them additional support, a successful haul of the towing-net has made me acquainted with another little genus, of which I had no previous knowledge. It was invested with a thick and globose cartilaginous envelope, with an irregular subterminal aperture, not very unlike that of the cartilaginous covering of the Pteropod *Eurybia*.

On endeavouring to remove the animal from this singular shell, I found that it was indeed but an external case, probably the egg-capsule itself; for the little creature very readily came away occupying the true shell, which was yet so membranous and delicate as to become folded by pressure, without fracture. The necessity of a further protection to the tiny occupant, cast abroad upon the ocean of life, will be at once apparent on inspecting the figure. The tentacula were of considerable length, with ocelli at their bases; and the mouth was encircled by a deeply cleft calyx of four segments, with richly ciliated margins. The foot much resembled that of *Atlanta*, minus the swimming plate, and presented a very distinct though rudimentary creeping disc and a broad three-lobed

posterior part bearing no operculum. The margin of the mantle, as in *Jasonilla*, was rather thick; and a pectinate gill extended along the dorsal region. The mouth was armed on each side with a beautifully set pavement of sharp-pointed labial teeth; and the lingual ribbon, supporting 7 series of members, exhibited the closest relationship to that of *Hyponyx* and *Pileopsis*. Finally, single spherical otolithes were apparent through the transparent pedicle of the foot. Here is an incontrovertible case of a young oceanic Gasteropod still undergoing development, but manifesting every essential anatomical character present in *Macgillivraia* and *Cheletropis*, which we have hitherto regarded as perfect forms.

EXPLANATION OF THE PLATE.

Tab. XLII.

Fig. 1. Little cancellated pelagic shell, closely resembling the minute spire of *Pedicularia*.
Figs. 2 & 3. Enlarged back and front views of the same.
Fig. 4. Small portion of the shell, more highly magnified to show its characteristic sculpturing agreeing with that of *Pedicularia*.
Fig. 5. The operculum.
Fig. 6. One transverse row of the lingual ribbon.
Fig. 7. A species of *Pedicularia* brought up from a depth of 40 fathoms, on a small Madrepore, 1 mile and a half off Elizabeth Reef. Lat. 29° 55′ 27″ S., Long. 159° 2′ 54″ E. (The natural size is seen to the left.)
Fig. 8. One transverse row of the lingual teeth of the same, for comparison with fig. 6, which is not so fully developed, but in other particulars very similar.
Fig. 9. Enlarged figures of a minute pelagic Gasteropod, having six ciliated arms and a clawed operculum, allied to a species previously figured and described.
Fig. 9 *a*. Portion of mantle with ciliated bands and processes, more highly magnified.
Fig. 10. Three-quarter view of the same shell.
Fig. 11. Lateral labial teeth.
Fig. 12. Lateral view of small pelagic Gasteropod enclosed in a stout cartilaginous case.
Fig. 13. Front view of the same.
Fig. 14. The animal removed from the outer case and slightly twisted in its rudimentary shell.
Fig. 15. The auditory capsule.
Fig. 16. Lateral labial teeth.
Fig. 17. Portion of lingual ribbon.